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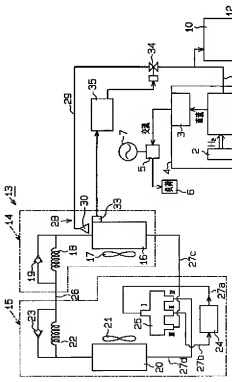
最終頁に続く

(54)【発明の名称】　空調装置の室外機の霜取装置

(57)【要約】
【課題】　ヒートポンプ式空調装置の室外機の霜取りを、燃料電池発電システムの排熱を有効に利用して簡単に行うことを可能にする。
【解決手段】　給水配管８で燃料電池１に供給された水は、燃料電池１を冷却することにより燃料電池１の排熱を回収し、湯となって排湯配管９から排出されて貯湯槽10に貯留される。室外機14に装備された熱交換器16には霜取装置28が設けられている。霜取装置28は、燃料電池１で温められた冷却媒体を、熱交換器16の上方に導く配管29と、配管29に設けられたシャワー部30とを備えている。霜取装置28は熱交換器16に霜が付着したことを検出するセンサ33を備えている。配管29は排湯配管９から分岐されている。制御装置35はセンサ33の検出信号に基づいて、熱交換器16に霜が付着したと判断すると、配管29に設けられた電磁弁34を開放して、配管29に湯の一部を供給し、シャワー部30から湯が熱交換器16にかけられる。



【特許請求の範囲】

【請求項１】　燃料電池発電システムの排熱で加熱された冷却媒体を、ヒートポンプ式空調装置の室外機へ、該室外機に装備された熱交換器の霜取り時に導く配管を設けた空調装置の室外機の霜取装置。

【請求項２】　前記配管は燃料電池の冷却に使用された冷却媒体を貯湯槽へ導く主配管から分岐され、該分岐配管には前記霜取り時に冷却媒体が主配管から分岐配管へ流入可能に切替え可能なバルブが設けられている請求項１に記載の空調装置の室外機の霜取装置。

【請求項３】　前記冷却媒体には燃料電池の冷却に使用された後、貯湯槽に貯留されて湯として使用可能な水が使用され、前記分岐配管は前記室外機に装備された熱交換器に冷却媒体をかけるように構成されている請求項２に記載の空調装置の室外機の霜取装置。

【請求項４】　前記主配管は閉ループをなし、燃料電池を冷却して昇温された冷媒を給湯用熱源として使用する熱交換器に導くように形成され、前記分岐配管も閉ループをなすように設けられている請求項２に記載の空調装置の室外機の霜取装置。

【請求項５】　前記霜取装置には前記熱交換器に霜が付着したことを検出するセンサが装備され、該センサの検出信号に基づいて前記配管における冷却媒体の流量が制御される請求項１～請求項４のいずれか一項に記載の空調装置の室外機の霜取装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は空調装置の室外機の霜取装置に係り、詳しくは燃料電池発電システムの排熱を有効利用する空調装置の室外機の霜取装置に関するものである。

【０００２】

【従来の技術】近年、ビルや住宅の電力エネルギー源として燃料電池を用いることが検討されている。燃料電池は、周知のように、たとえば酸素と水素とを化学反応させることで生じる起電力を利用するものであり、化学エネルギーが直接的に電気エネルギーに変換されるので優れた変換効率が得られる。

【０００３】燃料電池の作動は発熱を伴うため、発電時に発生する熱を回収していかに効率良く利用するかが、課題となっている。そして、燃料電池に冷却水を供給して冷却している。燃料電池を安定してかつ効率的に作動させるためには冷却水の供給温度を３０～４０℃程度とするのが好ましい。また、燃料電池を間欠的に運転することは効率的ではないので通常は連続運転され、燃料電池からは６０～８０℃程度の高温の冷却水が常時排出され、その温排水の処理も必要となる。

【０００４】例えば、特開平１１－２８１０７２号公報には、室外熱交換器及び室内熱交換器を有し、室外の熱を室内に汲み上げるヒートポンプサイクルを行う空調装置と、燃料電池と、燃料電池の排熱との間で熱交換して昇温された水を蓄える給湯装置と、前記空調装置が暖房運転を行っている時には前記燃料電池から排出された高温空気を前記室外熱交換器へ導き、前記空調装置が暖房を行っていない時には前記燃料電池から排出された高温空気を前記給湯装置へ導く排気切換手段とを有する熱供給システムが開示されている。

【０００５】このシステムでは、空調装置による暖房運転時には排気切換手段が燃料電池から排出された高温空気を空調装置の室外熱交換器へ導くことにより、燃料電池から排出された高温空気から空調装置の室外熱交換器により熱回収でき、この高温空気からの回収熱により熱交換の効率を高めることができる。また、空調装置が暖房運転を行っていない時には排気切換手段が燃料電池から排出された高温空気を給湯装置へ導くことにより、燃料電池から排出された高温空気から給湯装置により熱回収でき、この高温空気からの回収熱により水を昇温して温水として外部へ供給できるので、水を昇温するために必要となるエネルギーコストを抑制又は不要にできる。ここで、空調装置が暖房運転していない時とは、例えば、運転停止時，冷房運転時，除湿運転時，送風運転時等である。

【０００６】

【発明が解決しようとする課題】ところが、前記従来装置では、暖房運転を行う場合は、燃料電池の排熱を給湯装置の水の加熱に使用できない。暖房運転中、燃料電池の排熱を全て空調装置の室外熱交換器に導くため、この装置では室外機の霜取りは不要となるが、給湯装置における燃料電池の排熱の有効利用ができないという問題がある。

【０００７】ヒートポンプ式の空調装置では、暖房運転時に室外機の周囲の温度が数十度と高温でなくても、霜が付かない程度の温度であれば暖房は可能であるので、暖房運転中、常に燃料電池の排熱を室外機に供給しなくても十分暖房できる。しかし、室外機の熱交換器に霜が付いた状態で運転を続けると霜が成長して熱交換の効率が悪化して暖房ができなくなる。従って、一般のヒートポンプ式の空調装置では、霜が付くと除霜（デフロスト）作業が必要となる。

【０００８】本発明は前記従来の問題点に鑑みてなされたものであって、その目的はヒートポンプ式空調装置の室外機の霜取りを、燃料電池発電システムの排熱を有効に利用して簡単に行うことができる空調装置の室外機の霜取装置を提供することにある。

【０００９】

【課題を解決するための手段】前記の目的を達成するため請求項１に記載の発明では、燃料電池発電システムの排熱で加熱された冷却媒体を、ヒートポンプ式空調装置の室外機へ、該室外機に装備された熱交換器の霜取り時に導く配管を設けた。

【００１０】この発明では、燃料電池システムの排熱で加熱された冷却媒体が、ヒートポンプ式空調装置の室外機に装備された熱交換器の霜取りに使用される。霜取りに要する時間は比較的短時間のため、空調装置の暖房運転中燃料電池の排熱を室外機の熱交換器に供給する従来装置に比較して、燃料電池発電システムの排熱を給湯用に有効に利用できる。

【００１１】請求項２に記載の発明では、請求項１に記載の発明において、前記配管は燃料電池の冷却に使用された冷却媒体を貯湯槽へ導く主配管から分岐された分岐配管により、霜取り用の冷却媒体が室外機の熱交換器へ導かれる。従って、霜取り中も冷却媒体の一部を貯湯槽へ供給することができる。

【００１３】請求項３に記載の発明では、請求項２に記載の発明において、前記冷却媒体には燃料電池の冷却に使用された後、貯湯槽に貯留されて湯として使用可能な水が使用され、前記分岐配管は前記室外機に装備された熱交換器に冷却媒体をかけるように構成されている。

【００１４】この発明では、冷却媒体として水（例えば水道水）が使用され、霜取り時には燃料電池の排熱で加熱された温水が熱交換器に直接かけられるため、霜が効率良く除去される。また、熱交換器を使用して冷媒の熱で給湯用の水を温める構成に比較して、水を温める効率が良くなる。

【００１５】請求項４に記載の発明では、請求項２に記載の発明において、前記主配管は閉ループをなし、燃料電池を冷却して昇温された冷媒を給湯用熱源として使用する熱交換器に導くように形成され、前記分岐配管も閉ループをなすように設けられている。

【００１６】この発明では、燃料電池の排熱を利用するのに使用される冷媒は閉ループをなす主配管中を循環される。そして、室外機に装備された熱交換器の霜取り用に使用される冷媒も閉ループをなす分岐配管中を流れる。冷媒は閉ループの各配管内を循環するため、水以外の液体も使用でき、不凍液を使用することにより冬季（厳寒季）に燃料電池の運転を停止した状態で冷媒が各配管内で凍結する虞がない。

【００１７】請求項５に記載の発明では、請求項１～請求項４のいずれか一項に記載の発明において、前記霜取装置には前記熱交換器に霜が付着したことを検出するセンサが装備され、該センサの検出信号に基づいて前記配管における冷却媒体の流量が制御される。この発明では、霜取りが必要な状態になると霜取り作業が自動的に行われる。そのとき、冷却媒体を室外機の熱交換器に導く配管における流量が制御されるため、霜取りが効率良く行われる。

【００１８】

【発明の実施の形態】（第１の実施の形態）以下、本発明を具体化した第１の実施の形態を図１及び図２に従って説明する。

【００１９】図１に示すように、燃料電池発電システムは、燃料電池１、改質器２及びインバータ３が一つのハウジング４内に収容された燃料電池ユニットを備えている。燃料電池１は例えば固体高分子形の燃料電池からなり、改質器２で改質された原燃料と、空気とが供給され、改質ガス中の水素を空気中の酸素と反応させて直流の電気エネルギーを発生する。原燃料としては例えば都市ガスやＬＰガス等が使用される。

【００２０】インバータ３は入力側が燃料電池１の出力側に接続され、出力側が電力盤５を介して負荷６に接続されている。配電盤５は系統電源（商用電源）７とも接続されている。配電盤５は図示しない制御装置により、燃料電池１からの供給電力が負荷６の要求電力に足りないとき、系統電源７から電力を補うように構成されている。

【００２１】燃料電池発電システムは、給水配管８、主配管としての排湯配管９及び貯湯槽１０からなる排熱回収設備を備えている。給水配管８は水道管（図示せず）に連結され、その途中に電磁弁１１が設けられている。給水配管８で燃料電池１に供給された水は、燃料電池１を冷却することにより燃料電池１の排熱を回収し、湯（温水）となって排湯配管９から排出される。即ち、排熱回収設備は燃料電池１の冷却機能も果たす。貯湯槽１０の下部には給湯管１２が連結されている。給湯管１２は風呂、台所等（図示せず）への配管に連結されている。

【００２２】空調装置１３は、図１に示すように、家屋の外部に配置される室外機１４，家屋内に配置される室内機１５を備えている。室外機１４内には熱交換器１６、ファン１７、キャピラリチューブ１８及び逆止め弁１９を備えている。キャピラリチューブ１８及び逆止め弁１９は並列に連結されている。室内機１５も熱交換器２０、ファン２１、キャピラリチューブ２２及び逆止め弁２３を備え、さらに室内機１５には圧縮機２４及び四方弁２５が装備されている。キャピラリチューブ２２及び逆止め弁２３も並列に連結されている。両熱交換器１６，２０はキャピラリチューブ１８，２２が途中に配設された配管２６を介して連結されている。

【００２３】四方弁２５は、配管２７ａにより圧縮機２４の吐出ポートに連結されたポートＩと、配管２７ｂにより圧縮機２４の吸入ポートに連結されたポートＩＩと、配管２７ｃにより熱交換器１６に連結されたポートＩＩＩと、配管２７ｄにより熱交換器２０に連結されたポートＩＶとを備えている。

【００２４】四方弁２５は空調装置１３の制御装置（図示せず）からの指令により、暖房運転時には、ポートＩ

から入ったガスがポートIVから出て室内機１５の熱交換器２０及び逆止め弁２３と、室外機１４のキャピラリチューブ１８及び熱交換器１６を経てポートIII から四方弁２５に入り、次にポートIIから出て圧縮機２４の吸入ポートに吸入されるように機能する。また、冷房運転時には、ポートIから入ったガスがポートIII から出て室外機１４の熱交換器１６及び逆止め弁１９と、室内機１５のキャピラリチューブ２２及び熱交換器２０を経てポートIVから四方弁２５に入り、次にポートIIから出て圧縮機２４の吸入ポートに吸入されるように切り替えられる。

【００２５】室外機１４に装備された熱交換器１６には霜取装置２８が設けられている。図２に示すように、霜取装置２８は、燃料電池１の冷却に使用されて温められた冷却媒体を、霜取り時に熱交換器１６の上方に導く分岐配管としての配管２９と、配管２９に設けられたシャワー部３０と、熱交換器１６の下方に設けられた受け皿３１とを備えている。受け皿３１には排水管３２が連結されている。また、霜取装置２８は熱交換器１６に霜が付着したことを検出するセンサ３３を備えている。センサ３３は熱交換器１６の近傍の温度を検出する温度センサで構成されている。

【００２６】図１に示すように、配管２９は燃料電池１の冷却に使用された冷却媒体を貯湯槽１０へ導く排湯配管９から分岐されている。配管２９には霜取り時に冷却媒体が排湯配管９から配管２９へ流入可能に切替え可能なバルブとしての電磁弁３４が設けられている。制御装置３５はセンサ３３の検出信号に基づいて、熱交換器１６に霜が付着したと判断すると、電磁弁３４に開放指令を出力し、電磁弁３４が所定時間開放されるようになっている。

【００２７】次に前記のように構成された装置の作用を説明する。燃料電池１の運転時に電磁弁１１が開かれて水道水が給水配管８から燃料電池１へ導かれる。燃料電池１で発生した直流電力はインバータ３で交流に変換され、配電盤５を介して負荷６に供給される。燃料電池１を冷却して加熱された温水は排湯配管９を経て貯湯槽１０へ導かれる。貯湯槽１０に貯留された湯は給湯管１２を介して風呂、台所等に供給される。

【００２８】空調装置１３の暖房運転時には、四方弁２５の作用により、圧縮機２４の吐出ガスは室内機１５の熱交換器２０→逆止め弁２３→室外機１４のキャピラリチューブ１８→熱交換器１６→圧縮機２４の吸入ポートの順に移動する。そして、熱交換器１６が蒸発器として機能し、冷媒が外気の熱を奪って蒸発し、蒸発した冷媒ガスが圧縮機２４で圧縮され、室内機１５の熱交換器２０で放熱する。

【００２９】外気温が低下した状態で暖房運転を続けると、熱交換器１６に霜が付く。熱交換器１６に霜が付いた状態で暖房運転を行うと、暖房効率が非常に悪くなる。熱交換器１６に霜が付くと、センサ３３によりそれが検出され、制御装置３５からの指令により電磁弁３４が開放される。その結果、排湯配管９を介して貯湯槽１０へ供給される燃料電池１からの排出湯の一部が配管２９へ供給され、シャワー部３０から熱交換器１６にかけられる。配管２９が保温材で保温されていなくても、シャワー部３０から数十℃の湯が噴射されるため、熱交換器１６に付着した霜が効率良く除去される。シャワー部３０から噴射された湯は、除去された霜とともに受け皿３１で受けられ、排水管３２を介してダクトへ排出される。そして、霜の除去に必要な所定時間経過後、電磁弁３４が閉じられる。

【００３０】この実施の形態では以下の効果を有する。

（１）　空調装置１３の室外機１４に装備された熱交換器１６の霜取り時に、燃料電池１の冷却に使用されて加熱された冷媒を導く配管２９を設けた。従って、熱交換器１６の霜取りを、燃料電池発電システムの排熱を有効に利用して簡単に行うことができる。

【００３１】（２）　霜取りの際、燃料電池１の冷却に使用されて加熱された冷媒を熱交換器１６に直接かけるため、効率良く短時間で霜を除去できる。従って、燃料電池１で発生する熱の大部分を給湯用の湯に利用できる。

【００３２】（３）　配管２９は排湯配管９から分岐され、配管２９には霜取り時に冷却媒体（排出湯）が排湯配管９から配管２９へ流入可能に切替え可能な電磁弁３４が設けられている。従って、霜取り中も冷却媒体の一部を貯湯槽１０へ供給することができる。

【００３３】（４）　熱交換器１６に霜が付着したことを検出するセンサ３３が設けられているため、霜取りが必要な状態になると霜取り作業が自動的に行われる。

（５）　貯湯槽１０には燃料電池１を冷却して昇温された水が貯留される。従って、熱交換器を使用して冷媒の熱で貯湯槽１０内の給湯用の水を温める構成に比較して、水を温める効率が良くなる。

【００３４】（６）　燃料電池１の冷却媒体を閉ループで循環させて、熱交換器で貯湯槽１０の水を温める構成に比較して、熱交換器及び冷媒を循環させるためのポンプが不要になり、構造が簡単になるとともに、製造コストが安くなる。

【００３５】（第２の実施の形態）次に第２の実施の形態を図３に従って説明する。この実施の形態では燃料電池１の冷却に使用された冷媒が再度燃料電池１の冷却に使用される点、即ち冷媒が閉ループをなす配管内を循環する点が前記実施の形態と大きく異なっている。空調装置１３の構成は同じで、霜取装置２８の構成が異なっている。前記実施の形態と同一部分は同一符号を付して詳しい説明を省略する。また、電力供給に関する配電盤５等の図示を省略するとともに、空調装置１３については、熱交換器１６の部分のみ図示している。

【００３６】貯湯槽１０の下部には水道水を供給する給水管３６ａが連結され、上部には給湯管３６ｂが連結されている。燃料電池１を冷却する媒体が循環する閉ループをなす主配管としての配管３７の途中には、貯湯槽１０内の水を加熱する熱交換器３８が設けられている。配管３７には熱交換器３８より下流側にポンプ３９が設けられている。配管３７にはポンプ３９より下流側に分岐配管４０が閉ループをなすように設けられている。分岐配管４０の途中と、分岐配管４０の配管３７からの二つの分岐点の中間とに電磁弁３４，４１が設けられている。分岐配管４０は熱交換器１６と対応する位置では熱交換器１６に沿って蛇行するように配設されている。

【００３７】この実施の形態の装置では、貯湯槽１０内の水は配管３７内を循環する冷却媒体により熱交換器３８を介して加熱される。霜取り作業が不要なときは、電磁弁３４が閉鎖されるとともに電磁弁４１が開放された状態に保持され、冷却媒体は配管３７内を循環する。一方、霜取りが必要なときは、電磁弁３４が開放されるとともに電磁弁４１が閉鎖された状態に保持される。そして、燃料電池１で加熱された冷却媒体は配管３７を介して熱交換器３８に導かれ、貯湯槽１０内の水を加熱した後、ポンプ３９を経て分岐配管４０に導かれ、熱交換器１６に付着した霜を加熱して除去する。その後、燃料電池１へ供給される。

【００３８】この実施の形態では前記実施の形態の（１）及び（４）の効果を有する他に次の効果を有する。

（７）　燃料電池１は閉ループを循環する冷却媒体で冷却され、貯湯槽１０には燃料電池１を冷却して昇温された冷却媒体を熱源として使用する熱交換器３８で昇温された水が貯留される。従って、冷媒は閉ループの配管３７内を循環するため、水以外の液体も使用でき、不凍液を使用することにより冬季（厳寒季）に燃料電池１の運転を停止した状態でも冷媒が配管３７内で凍結する虞がない。

【００３９】（８）　霜取り作用をなす冷却媒体は貯湯槽１０内の水を加熱した後、閉ループの分岐配管４０内を流れるため、霜取り作業中でも貯湯槽１０内の水の加熱が確実に行われ、燃料電池発電システムの排熱をより有効に利用できる。

【００４０】（９）　貯湯槽１０への給水が下から行われ、給湯が上から行われる。従って、貯湯槽１０内で温度の高い水が上側に温度の低い水は下側に貯留され、貯湯槽１０内の全体の水が所定温度に加熱される前に、上側の水が所定温度に加熱されて使用可能となる。

【００４１】実施の形態は前記に限定されるものではなく、例えば次のように構成してもよい。

○　第１の実施の形態のように燃料電池１を冷却した水を貯湯槽１０に貯留する構成の装置において、配管２９を主配管（排湯配管９）から分岐させる構成に代えて、燃料電池１を冷却して加熱された後の水を、直接熱交換器１６へ導く構成としてもよい。例えば、霜取り用の配管と、該配管に燃料電池１を介して水を供給する給水配管を設ける。給水配管には霜取り時に水を燃料電池１に供給するバルブを設ける。

【００４２】○　第１の実施の形態において、配管２９の途中に電磁弁３４を設ける代わりに、排湯配管９と配管２９との分岐部に三方弁を設け、霜取り時以外は排湯を貯湯槽１０へ供給し、霜取り時には排湯を配管２９側へ供給するようにしてもよい。この場合、霜取り時に確実に排湯を熱交換器１６にかけることができる。

【００４３】○　第２の実施の形態において、分岐配管４０及び配管３７に電磁弁３４，４１を設ける代わりに、分岐配管４０の二つの分岐部のうちの上流側の分岐部に三方弁を設け、霜取り時以外は排湯を配管３７側へ通過させ、霜取り時には排湯を分岐配管４０側へ通過させるように切り替えるようにしてもよい。この場合、２個の電磁弁３４，４１を設ける必要がなく、構成が簡単になる。

【００４４】○　燃料電池１を冷却する冷媒を循環使用する構成において、ポンプ３９を熱交換器３８の下流側に配設する代わりに上流側に配設してもよい。しかし、下流側の方が冷媒の温度が低いため、耐久性が向上する。

【００４５】○　熱交換器１６に霜が付着したことを検出するセンサ３３として、温度センサに代えて、光センサを使用してもよい。例えば反射式の光センサを使用する構成では、熱交換器１６の所定位置に光り反射性の良い反射シートを固着し、その反射シートからの反射光をセンサで検出する。熱交換器１６に霜が付くと反射シートの表面にも霜が付着して反射光が弱くなり、霜が付着したことが検出される。また、透過式の光センサを使用する構成では、投光部からの投光が熱交換器１６の表面の極近傍を通過するように投光部を配置し、受光部でその投光を検知する。熱交換器１６に霜が付くと投光が遮られるため、霜が付着したことを検出できる。

【００４６】○　熱交換器１６に霜が付いたことを直接検出する代わりに、室外機１４の近傍の気温と暖房運転継続時間とから霜が付着する条件を予め実験などで求めておき、気温と暖房運転継続時間とから霜が付着する条件となったときに、所定時間前記霜取り作業を行うようにしてもよい。この場合、霜取装置２８にセンサ３３を設ける必要がなくなる。

【００４７】○　電磁弁３４，４１に代えて手動操作弁を設け、霜が付いた時に手動操作で配管２９や分岐配管４０に冷媒を流すようにしてもよい。

○　貯湯槽１０内の水を加熱するのに、燃料電池１の冷却水の熱だけを利用する代わりに、改質器２の排熱を熱媒体で回収し、管路を介してその熱媒体を貯湯槽１０に設けた別の熱交換器に供給し、貯湯槽１０内の水を加熱

するのに使用する構成としてもよい。この場合、燃料電池発電システムの熱効率が向上する。

【００４８】前記実施の形態から把握される請求項記載以外の発明（技術思想）について、以下に記載する。

（１）　請求項１～請求項４のいずれか一項に記載の発明において、霜取り作業が必要か否かは、外気温と連続暖房運転時間とに基づいて判断される。

【００４９】

【発明の効果】以上詳述したように請求項１～請求項５に記載の発明によれば、ヒートポンプ式空調装置の室外機の霜取りを、燃料電池発電システムの排熱を有効に利用して簡単に行うことができる。

【図面の簡単な説明】

【図１】　第１の実施の形態の燃料電池発電システムの構成図。

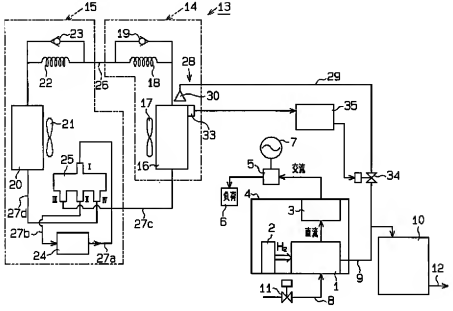
【図２】　霜取装置の模式図。

【図３】　第２の実施の形態の燃料電池発電システムの構成図。

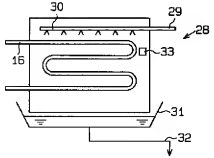
【符号の説明】

１…燃料電池、９…主配管としての排湯配管、１０…貯湯槽、１３…空調装置、１４…室外機、１６…熱交換器、２９…分岐配管としての配管、３４，４１…バルブとしての電磁弁、３７…主配管としての配管、４０…分岐配管。

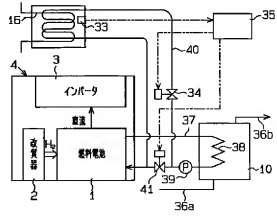
【図１】



【図２】



【図３】



フロントページの続き

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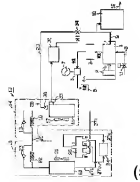
(54) DEFROSTING DEVICE OF OUTDOOR UNIT OF AIR CONDITIONER



(57)Abstract:

PROBLEM TO BE SOLVED: To easily perform defrosting operation of an outdoor unit of a heat pump type air conditioner by effectively using waste heat of a fuel cell power generation system.

SOLUTION: Water supplied to a fuel cell 1 by a water supply pipe 8 cools the fuel cell 1 to recover waste heat of the fuel cell 1, and becomes hot water before being discharged through a hot water discharge pipe 9 and stored in a hot water tank 10. A heat exchanger 16 on the outdoor unit 14 is provided with a defrosting device 28. The defrosting device 28 comprises a pipe 29 for guiding a cooling medium heated by the fuel cell 1 upward of the heat exchanger 16, and a shower unit 30 on the pipe 29. A sensor 33 for detecting adhesion of frost on the heat exchanger 16 is provided on the defrosting device 28. The pipe 29 is branched from the pipe 9. A controller 35 opens a solenoid valve 34 provided in the pipe 29 when the heat exchanger 16 is judged to be frosted on the basis of a detection signal of the sensor 33 so as to supply part of hot water to the pipe 29 and the hot water is showered onto the heat exchanger 16 from the shower unit 30.

LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against
examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] Defrosting equipment of the exterior unit of the air conditioner which prepared piping which leads the cooling medium heated with the exhaust heat of a fuel cell generation-of-electrical-energy system to the exterior unit of a heat pump type air conditioner at the time of the defroster of a heat exchanger equipped by this exterior unit.

[Claim 2] Said piping is defrosting equipment of the exterior unit of the air conditioner according to claim 1 with which it branches from the process line which leads the cooling medium used for cooling of a fuel cell to a hot water storage tank, and the cooling medium is formed for the bulb which can be changed possible [an inflow] in this branch line from the process line to the branch line at the time of said defroster.

[Claim 3] It is defrosting equipment of the exterior unit of the air conditioner according to claim 2 which it is stored by the hot water storage tank and water usable as a molten bath is used, and is constituted so that said branch line may cover a cooling medium over the heat exchanger with which said exterior unit was equipped after being used for said cooling medium by cooling of a fuel cell.

[Claim 4] Said process line is defrosting equipment of the exterior unit of the air conditioner according to claim 2 formed so that it may be formed so that the refrigerant by which temperature up was cooled and carried out [fuel cell / nothing and] in the closed loop may be led to the heat exchanger used as a heat source for hot water supply, and said branch line may also make a closed loop.
[Claim 5] Defrosting equipment of the exterior unit of an air conditioner given in any 1 term of claim 1 by which said defrosting equipment is equipped with the sensor which detects that frost adhered to said heat exchanger, and the flow rate of the cooling medium in said piping is controlled based on the detecting signal of this sensor - claim 4.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the defrosting equipment of the exterior unit of an air conditioner, and relates to the defrosting equipment of the exterior unit of the air conditioner which uses effectively the exhaust heat of a fuel cell generation-of-electrical-energy system in detail.

[0002]

[Description of the Prior Art] Using a fuel cell as a power energy source of a building or a residence in recent years is examined. The electromotive force which produces oxygen and hydrogen by carrying out a chemical reaction as everyone knows is used for a fuel cell, and the conversion efficiency which was excellent since chemical energy was directly transformed into electrical energy is acquired.

[0003] It has been a technical problem how since actuation of a fuel cell is accompanied by generation of heat, it collects the heat generated at the time of a generation of electrical energy, and uses it efficiently. And cooling water was supplied to the fuel cell and it has cooled to it. In order to make it operate efficiently [a fuel cell is stabilized and], it is desirable to make supply temperature of cooling water into about 30-40 degrees C. Moreover, since it is not efficient, it usually runs continuously operating a fuel cell intermittently, and from a fuel cell, about 60-80-degree C hot cooling water is always discharged, and processing of the thermal wastewater is also needed.

[0004] for example, to JP,11-281072,A The air conditioner which performs the heat pump cycle which has an outdoor heat exchanger and indoor heat exchanger, and pumps up outdoor heat indoors, The hot-water-supply equipment in which the water by which temperature up was carried out by carrying out heat exchange between a fuel cell and the exhaust heat of a fuel cell is stored, The elevated-temperature air discharged from said fuel cell while said air conditioner was performing heating operation is led to said outdoor heat exchanger. While said air conditioner is not heating, the heat distribution system which has the exhaust air means for switching which leads the elevated-temperature air discharged from said fuel cell to said hot-water-supply equipment is indicated.

[0005] In this system, by leading the elevated-temperature air by which the exhaust air means for switching was discharged from the fuel cell to the outdoor heat exchanger of an air conditioner at the time of heating operation by the air conditioner, heat recovery can be carried out by the outdoor heat exchanger of

an air conditioner from the elevated-temperature air discharged from the fuel cell, and the recovery heat from this elevated-temperature air can raise the effectiveness of heat exchange. Moreover, since heat recovery can be carried out with hot-water-supply equipment from the elevated-temperature air discharged from the fuel cell by leading the elevated-temperature air by which the exhaust air means for switching was discharged from the fuel cell to hot-water-supply equipment, temperature up of the water is carried out with the recovery heat from this elevated-temperature air, it considers as warm water and the exterior can be supplied when the air conditioner omits heating operation, energy cost which is needed in order to carry out temperature up of the water is made to control or needlessness. Here, when the air conditioner has not carried out heating operation, it is the air blasting operation time etc. at the time of dehumidification operation at the time of cooling operation at the time of shutdown.

[0006]

[Problem(s) to be Solved by the Invention] However, conventionally [said], with equipment, when performing heating operation, exhaust heat of a fuel cell cannot be used for heating of the water of hot-water-supply equipment. Although it becomes unnecessary [the defroster of an exterior unit] with this equipment in order to lead all the exhaust heat of a fuel cell to the outdoor heat exchanger of an air conditioner, there is a problem that a deployment of the exhaust heat of the fuel cell in hot-water-supply equipment cannot be performed during heating operation.

[0007] Since heating is possible if it is the temperature which is extent to which frost is not attached at the time of heating operation even if the temperature around an exterior unit is not dozens of times and an elevated temperature, even if it always does not supply the exhaust heat of a fuel cell to an exterior unit, it can heat by the heat pump-type air conditioner enough during heating operation. However, where frost is attached to the heat exchanger of an exterior unit, it it continues operation, frost grows, the effectiveness of heat exchange gets worse,

and heating becomes impossible. Therefore, in a general heat pump-type air conditioner, when frost is attached, defrosting (defrost) is needed.

[0008] This invention is made in view of said conventional trouble, and the object is in offering the defrosting equipment of the exterior unit of the air conditioner which can perform easily the defroster of the exterior unit of a heat pump type air conditioner, using effectively the exhaust heat of a fuel cell generation-of-electrical-energy system.

[0009]

[Means for Solving the Problem] In order to attain the aforementioned object, in invention according to claim 1, piping which leads the cooling medium heated with the exhaust heat of a fuel cell generation-of-electrical-energy system to the exterior unit of a heat pump type air conditioner at the time of the defroster of a heat exchanger equipped by this exterior unit was prepared.

[0010] In this invention, the cooling medium heated with the exhaust heat of a fuel cell system is used for the defroster of a heat exchanger with which the exterior unit of a heat pump type air conditioner was equipped. The time amount which a defroster takes can use the exhaust heat of a fuel cell generation-of-electrical-energy system effective in hot water supply comparatively as compared with equipment conventionally which supplies the exhaust heat of a fuel cell to the heat exchanger of an exterior unit during heating operation of an air conditioner for a short time.

[0011] In invention according to claim 2, in invention according to claim 1, said piping branches from the process line which leads the cooling medium used for cooling of a fuel cell to a hot water storage tank, and the cooling medium is formed for the bulb which can be changed possible [an inflow] in this branch line from the process line to the branch line at the time of said defroster.

[0012] In this invention, the cooling medium for defrosters is led to the heat exchanger of an exterior unit by the branch line which branched from the process line which leads the cooling medium used for cooling of a fuel cell to a hot water storage tank. Therefore, the inside of a defroster can also supply some cooling

media to a hot water storage tank.

[0013] In invention according to claim 2, after being used for said cooling medium by cooling of a fuel cell, it is stored by the hot water storage tank and water usable as a molten bath is used, and said branch line consists of invention according to claim 3 so that a cooling medium may be covered over the heat exchanger with which said exterior unit was equipped.

[0014] In this invention, water (for example, tap water) is used as a cooling medium, and whether the warm water heated with the exhaust heat of a fuel cell at the time of a defroster is direct to a heat exchanger, and since it is kicked, frost is removed efficiently. Moreover, as compared with the configuration which warms the water for hot water supply with the heat of a refrigerant using a heat exchanger, the effectiveness which warms water becomes good.

[0015] In invention according to claim 4, in invention according to claim 2, said process line is formed so that the refrigerant by which temperature up was cooled and carried out [fuel cell / nothing and] in the closed loop may be led to the heat exchanger used as a heat source for hot water supply, and it is prepared so that said branch line may also make a closed loop.

[0016] In this invention, the refrigerant used for using the exhaust heat of a fuel cell circulates through the inside of the process line which makes a closed loop. And the refrigerant used for the defrosters of the heat exchanger with which the exterior unit was equipped also flows the inside of the branch line which makes a closed loop. Since a refrigerant circulates through the inside of each piping of a closed loop, it can also use liquids other than water and there is no possibility that a refrigerant may be frozen within each piping where operation of a fuel cell is suspended in winter (******) by using the antifreezing solution.

[0017] In invention given in any 1 term of claim 1 - claim 4, said defrosting equipment is equipped with the sensor which detects that frost adhered to said heat exchanger, and the flow rate of the cooling medium in said piping is controlled by invention according to claim 5 based on the detecting signal of this sensor. In this invention, if a defroster will be in a required condition, a defroster

activity will be done automatically. Since the flow rate in piping which leads a cooling medium to the heat exchanger of an exterior unit is then controlled, a defroster is performed efficiently.

[0018]

[Embodiment of the Invention] (Gestalt of the 1st operation) The gestalt of the 1st operation which materialized this invention is hereafter explained according to drawing 1 and drawing 2 .

[0019] As shown in drawing 1 , the fuel cell generation-of-electrical-energy system is equipped with the fuel cell unit with which the fuel cell 1, the refining machine 2, and the inverter 3 were held in one housing 4. Consist of a fuel cell of for example, a solid-state macromolecule form, the original fuel by which refining was carried out with the refining vessel 2, and air are supplied, and a fuel cell 1 makes the hydrogen in reformed gas react with the oxygen in air, and generates the electrical energy of a direct current. Town gas, LP gas, etc. are used as a original fuel.

[0020] An input side is connected to the output side of a fuel cell 1, and, as for the inverter 3, the output side is connected to the load 6 through the switchboard 5. The switchboard 5 is connected also with the system power source (source power supply) 7. By the control unit which is not illustrated, when the supply voltage from a fuel cell 1 is insufficient to the demand power of a load 6, the switchboard 5 is constituted so that it may compensate with power from the system power source 7.

[0021] The fuel cell generation-of-electrical-energy system is equipped with the exhaust-heat-recovery facility which consists of the waste-hot-water piping 9 and the hot water storage tank 10 as water supply piping 8 and a process line. Water supply piping 8 is connected with a water pipe (not shown), and the solenoid valve 11 is formed in the middle. By cooling a fuel cell 1, the water supplied to the fuel cell 1 by water supply piping 8 collects the exhaust heat of a fuel cell 1, serves as a molten bath (warm water), and is discharged from the waste-hot-water piping 9. That is, the cooling function of a fuel cell 1 also achieves an

exhaust-heat-recovery facility. The hot-water pipe 12 is connected with the lower part of a hot water storage tank 10. The hot-water pipe 12 is connected with piping (not shown) to a bath, a kitchen, etc.

[0022] The air conditioner 13 is equipped with the exterior unit 14 arranged to the exterior of a house, and the interior unit 15 arranged in a house as shown in drawing 1 . In the exterior unit 14, it has the heat exchanger 16, the fan 17, the capillary tube 18, and the check valve 19. The capillary tube 18 and the check valve 19 are connected with juxtaposition. An interior unit 15 is also equipped with a heat exchanger 20, a fan 21, a capillary tube 22, and a check valve 23, and the interior unit 15 is further equipped with the compressor 24 and the four-way valve 25. The capillary tube 22 and the check valve 23 are also connected with juxtaposition. Both the heat exchangers 16 and 20 are connected through the piping 26 in which capillary tubes 18 and 22 were arranged on the way.

[0023] A four-way valve 25 is the port I connected with the regurgitation port of a compressor 24 by piping 27a, the port II connected with the inhalation port of a compressor 24 by piping 27b, and the port III connected with the heat exchanger 16 by piping 27c. It has the port IV connected with the heat exchanger 20 by 27d of piping.

[0024] by the command from the control unit (not shown) of an air conditioner 13, at the time of heating operation, the gas which entered from Port I should come out from Port IV, and a four-way valve 25 should pass the heat exchanger 20 of an interior unit 15 and a check valve 23, and the capillary tube 18 and heat exchanger 16 of an exterior unit 14 -- port III from -- it goes into a four-way valve 25, and functions as coming out from Port II next and being inhaled in the inhalation port of a compressor 24. moreover, the gas which entered from Port I at the time of cooling operation -- port III from -- come out and pass the heat exchanger 16 of an exterior unit 14 and a check valve 19, and the capillary tube 22 and heat exchanger 20 of an interior unit 15 -- it goes into a four-way valve 25 from Port IV, and it changes so that it may next come out from Port II and may be inhaled in the inhalation port of a compressor 24.

[0025] Defrosting equipment 28 is formed in the heat exchanger 16 with which the exterior unit 14 was equipped. As shown in drawing 2 , defrosting equipment 28 is equipped with the piping 29 as a branch line which leads the cooling medium which it was used for cooling of a fuel cell 1, and was able to be warmed above a heat exchanger 16 at the time of a defroster, the shower section 30 prepared in piping 29, and the saucer 31 on which the heat exchanger 16 was formed caudad. The drain pipe 32 is connected with the saucer 31. Moreover, defrosting equipment 28 is equipped with the sensor 33 which detects that frost adhered to the heat exchanger 16. The sensor 33 consists of temperature sensors which detect the temperature near the heat exchanger 16.
[0026] As shown in drawing 1 , piping 29 has branched from the waste-hot-water piping 9 which leads the cooling medium used for cooling of a fuel cell 1 to a hot water storage tank 10. For piping 29, the solenoid valve 34 as a bulb which can be changed possible [an inflow] is formed for the cooling medium in piping 29 from the waste-hot-water piping 9 at the time of a defroster. If a control unit 35 judges that frost adhered to the heat exchanger 16 based on the detecting signal of a sensor 33, it will output an open command to a solenoid valve 34, and predetermined time disconnection of the solenoid valve 34 is carried out.
[0027] Next, an operation of the equipment constituted as mentioned above is explained. At the time of operation of a fuel cell 1, a solenoid valve 11 is opened and tap water is led to a fuel cell 1 from water supply piping 8. The direct current power generated with the fuel cell 1 is changed into an alternating current with an inverter 3, and is supplied to a load 6 through a switchboard 5. The warm water which cooled the fuel cell 1 and was heated is led to a hot water storage tank 10 through the waste-hot-water piping 9. The molten bath stored by the hot water storage tank 10 is supplied to a bath, a kitchen, etc. through a hot-water pipe 12.
[0028] At the time of heating operation of an air conditioner 13, the regurgitation gas of a compressor 24 moves according to an operation of a four-way valve 25 in order of the inhalation port of the capillary tube 18 -> heat-exchanger 16 -> compressor 24 of the heat-exchanger 20 -> check valve 23 -> exterior unit 14 of

an interior unit 15. And a heat exchanger 16 functions as an evaporator, and the refrigerant gas in which the refrigerant took the heat of the open air, and evaporated and evaporated is compressed with a compressor 24, and radiates heat by the heat exchanger 20 of an interior unit 15.

[0029] After outside air temperature has fallen, when heating operation is continued, frost is attached to a heat exchanger 16. Heating effectiveness will get very bad, if heating operation is performed where frost is attached to a heat exchanger 16. If frost is attached to a heat exchanger 16, it will be detected by the sensor 33 and a solenoid valve 34 will be opened by the command from a control unit 35. Consequently, some blowdown molten baths from the fuel cell 1 supplied to a hot water storage tank 10 through the waste-hot-water piping 9 are supplied to piping 29, and it is applied to a heat exchanger 16 from the shower section 30. Since a dozens of degrees C molten bath is injected from the shower section 30 even if piping 29 is not kept warm with heat insulating material, the frost adhering to a heat exchanger 16 is removed efficiently. The molten bath injected from the shower section 30 is discharged through a carrier eclipse and a drain pipe 32 to a duct on a saucer 31 with the removed frost. And a solenoid valve 34 is closed after predetermined time progress required for clearance of frost.

[0030] With the gestalt of this operation, it has the following effectiveness.

(1) The piping 29 which leads the refrigerant which was used for cooling of a fuel cell 1 and heated at the time of the defroster of a heat exchanger 16 with which the exterior unit 14 of an air conditioner 13 was equipped was formed. Therefore, the defroster of a heat exchanger 16 can be performed easily, using effectively the exhaust heat of a fuel cell generation-of-electrical-energy system.

[0031] (2) Whether it is direct to a heat exchanger 16 in the refrigerant which was used for cooling of a fuel cell 1 at the time of a defroster, and was heated, and since it kicks, frost is efficiently removable in a short time. Therefore, most heat generated with a fuel cell 1 can be used for the molten bath for hot water supply.

[0032] (3) Piping 29 branches from the waste-hot-water piping 9, and the

solenoid valve 34 which can be changed possible [an inflow] is formed for the cooling medium (blowdown molten bath) in piping 29 from the waste-hot-water piping 9 to piping 29 at the time of a defroster. Therefore, the inside of a defroster can also supply some cooling media to a hot water storage tank 10.

[0033] (4) Since the sensor 33 which detects that frost adhered to the heat exchanger 16 is formed, if a defroster will be in a required condition, a defroster activity will be done automatically.

(5) The water by which cooled the fuel cell 1 to the hot water storage tank 10, and temperature up was carried out to it is stored. Therefore, as compared with the configuration which warms the water for the hot water supply in a hot water storage tank 10 with the heat of a refrigerant using a heat exchanger, the effectiveness which warms water becomes good.

[0034] (6) A manufacturing cost becomes cheap, while circulating the cooling medium of a fuel cell 1 by the closed loop, the pump for circulating a heat exchanger and a refrigerant as compared with the configuration which warms the water of a hot water storage tank 10 by the heat exchanger becoming unnecessary and structure's becoming easy.

[0035] (Gestalt of the 2nd operation) The gestalt of the 2nd operation is explained below according to drawing 3 . With the gestalt of this operation, the point, i.e., the point that a refrigerant circulates through the inside of piping which makes a closed loop, that the refrigerant used for cooling of a fuel cell 1 is again used for cooling of a fuel cell 1 differs from the gestalt of said operation greatly. The configuration of an air conditioner 13 is the same, and the configurations of defrosting equipment 28 differ. The same part as the gestalt of said operation attaches the same sign, and omits detailed explanation. Moreover, while omitting the graphic display of the switchboard 5 grade about an electric power supply, only the part of a heat exchanger 16 is illustrated about the air conditioner 13.

[0036] Feed pipe 36a which supplies tap water is connected with the lower part of a hot water storage tank 10, and hot-water pipe 36b is connected with the upper part. In the middle of the piping 37 as a process line which makes the

closed loop through which the medium which cools a fuel cell 1 circulates, the heat exchanger 38 which heats the water in a hot water storage tank 10 is formed. The pump 39 is formed in piping 37 from the heat exchanger 38 at the downstream. It is prepared in piping 37 so that a branch line 40 may make a closed loop from a pump 39 to the downstream. Solenoid valves 34 and 41 are formed in the middle of a branch line 40, and the medium of the two branch points from the piping 37 of a branch line 40. The branch line 40 is arranged in the heat exchanger 16 and the corresponding location so that it may move in a zigzag direction along with a heat exchanger 16.

[0037] With the equipment of the gestalt of this operation, the water in a hot water storage tank 10 is heated through a heat exchanger 38 by the cooling medium which circulates through the inside of piping 37. When a defroster activity is unnecessary, while a solenoid valve 34 is closed, it is held at the condition that the solenoid valve 41 was opened, and a cooling medium circulates through the inside of piping 37. On the other hand, when a defroster is required, while a solenoid valve 34 is opened, it is held at the condition that the solenoid valve 41 was closed. And after the cooling medium heated with the fuel cell 1 is led to a heat exchanger 38 through piping 37 and heats the water in a hot water storage tank 10, it is led to a branch line 40 through a pump 39, and heats and removes the frost adhering to a heat exchanger 16. Then, a fuel cell 1 is supplied.

[0038] With the gestalt of this operation, it has (1) of the gestalt of said operation, and the effectiveness of (4), and also has the following effectiveness.

(7) A fuel cell 1 is cooled with the cooling medium which circulates through a closed loop, and the water by which temperature up was carried out by the heat exchanger 38 which uses the cooling medium by which cooled the fuel cell 1 and temperature up was carried out as a heat source is stored by the hot water storage tank 10. Therefore, since a refrigerant circulates through the inside of the piping 37 of a closed loop, it can also use liquids other than water and there is no possibility that a refrigerant may be frozen within piping 37 also where operation

of a fuel cell 1 is suspended in winter (******) by using the antifreezing solution.
[0039] (8) Since the cooling medium which makes a defroster operation flows the inside of the branch line 40 of a closed loop after heating the water in a hot water storage tank 10, also in a defroster activity, heating of the water in a hot water storage tank 10 is ensured, and it can use more the exhaust heat of a fuel cell generation-of-electrical-energy system for validity.
[0040] (9) The feed water to a hot water storage tank 10 is performed from the bottom, and hot water supply is performed from a top. Therefore, upper water is heated by predetermined temperature and the water with low temperature becomes usable, before water with high temperature is stored in the bottom by the upside within a hot water storage tank 10 and the water in [whole] a hot water storage tank 10 is heated by predetermined temperature.
[0041] The gestalt of operation is not limited above and may be constituted as follows.
O In the equipment of a configuration of storing in a hot water storage tank 10 the water which cooled the fuel cell 1 like the gestalt of the 1st operation, it is good also as a configuration which leads water after replacing with the configuration which branches piping 29 from a process line (waste-hot-water piping 9), cooling the fuel cell 1 and being heated to the direct heat exchanger 16. For example, the water supply piping which supplies water to piping and this piping for defrosters through a fuel cell 1 is prepared. The bulb which supplies water to a fuel cell 1 at the time of a defroster is prepared in water supply piping.
[0042] O Instead of forming a solenoid valve 34 in the middle of piping 29, a cross valve is prepared in the tee of the waste-hot-water piping 9 and piping 29, and waste hot water is supplied to a hot water storage tank 10, and you may make it supply waste hot water to a piping 29 side in the gestalt of the 1st operation at the time of a defroster except the time of a defroster. In this case, waste hot water can be certainly covered over a heat exchanger 16 at the time of a defroster.
[0043] O Instead of forming solenoid valves 34 and 41 in a branch line 40 and

piping 37, a cross valve is prepared in the tee of the upstream of the two tees of a branch line 40, and waste hot water is passed to a piping 37 side, and you may make it change in the gestalt of the 2nd operation, at the time of a defroster except the time of a defroster, so that waste hot water may be passed to a branch-line 40 side. In this case, it is not necessary to form two solenoid valves 34 and 41, and a configuration becomes easy.

[0044] O In the configuration which carries out the cyclic use of waste water of the refrigerant which cools a fuel cell 1, you may arrange in the upstream instead of arranging a pump 39 in the downstream of a heat exchanger 38. However, since the direction of the downstream has the low temperature of a refrigerant, endurance improves.

[0045] O As a sensor 33 which detects that frost adhered to the heat exchanger 16, it may replace with a temperature sensor and a photosensor may be used. For example, with the configuration which uses a reflective-type photosensor, it shines in the predetermined location of a heat exchanger 16, a reflexible good reflective sheet is fixed, and a sensor detects the reflected light from the reflective sheet. If frost is attached to a heat exchanger 16, it will be detected that frost adhered also to the front face of a reflective sheet, the reflected light became weak and frost adhered. Moreover, with the configuration which uses a transparency-type photosensor, the floodlighting section is arranged so that the floodlighting from the floodlighting section may pass near the pole of the front face of a heat exchanger 16, and the floodlighting is detected by the light sensing portion. Since floodlighting will be interrupted if frost is attached to a heat exchanger 16, it is detectable that frost adhered.

[0046] O The conditions to which frost adheres are beforehand searched for in the experiment etc. from the atmospheric temperature near the exterior unit 14, and heating operation duration time, and when it becomes the conditions to which frost adheres from atmospheric temperature and heating operation duration time, it may be made to do the predetermined time aforementioned defroster activity instead of carrying out direct detection of frost having been

attached to the heat exchanger 16. It becomes unnecessary in this case, to form a sensor 33 in defrosting equipment 28.

[0047] O It replaces with solenoid valves 34 and 41, and a hand operated valve is prepared, and when frost is attached, you may make it pour a refrigerant to piping 29 or a branch line 40 by manual operation.

O It is good also as a configuration used for a heat carrier recovering the exhaust heat of the refining machine 2, supplying another heat exchanger which formed the heat carrier through the duct at the hot water storage tank 10, and heating the water in a hot water storage tank 10 instead of using only the heat of the cooling water of a fuel cell 1, although the water in a hot water storage tank 10 is heated. In this case, the thermal efficiency of a fuel cell generation-of-electrical-energy system improves.

[0048] Invention other than the claim publication grasped from the gestalt of said operation (technical thought) is indicated below.

(1) In invention given in any 1 term of claim 1 - claim 4, a defroster activity is judged based on outside air temperature and continuous heating operation time in whether it is the need.

[0049]

[Effect of the Invention] As explained in full detail above, according to invention according to claim 1 to 5, the defroster of the exterior unit of a heat pump type air conditioner can be performed easily, using effectively the exhaust heat of a fuel cell generation-of-electrical-energy system.

[Translation done.]

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Fuel cell generation-of-electrical-energy structure-of-a-system drawing of the gestalt of the 1st operation.

[Drawing 2] The mimetic diagram of defrosting equipment.

[Drawing 3] Fuel cell generation-of-electrical-energy structure-of-a-system drawing of the gestalt of the 2nd operation.

[Description of Notations]

1 [-- An air conditioner, 14 / -- An exterior unit, 16 / -- A heat exchanger, 29 / -- 34 Piping as a branch line 41 / -- The solenoid valve as a bulb 37 / -- Piping as a process line, 40 / -- Branch line.] -- A fuel cell, 9 -- Waste-hot-water piping as a process line, 10 -- A hot water storage tank, 13

[Translation done.]

* NOTICES *

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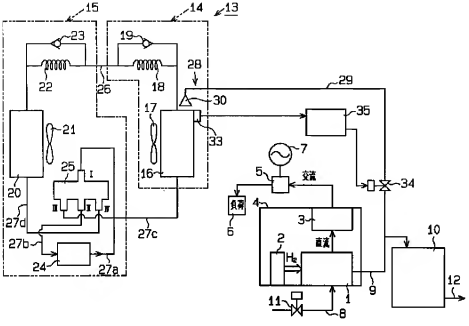
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

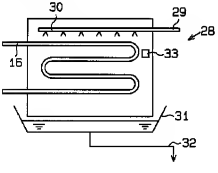
3.In the drawings, any words are not translated.

DRAWINGS

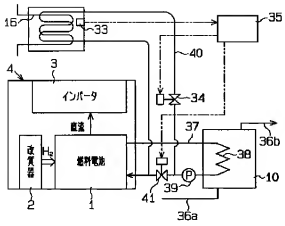
[Drawing 1]



[Drawing 2]



[Drawing 3]



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